INSTRUCTION MANUAL

HF ALL BAND

2KW TUBE TYPE LINEAR AMPLIFIER

MODEL HL-2K

TOKYO HY-POWER LABS., INC.

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[1] PREFACE

- Before setting to start operating the device, read this instruction manual carefully to keep your HL-2K in the best condition for a long time.

- The high voltage of over 3000V is applied in the internal part of the device.

  Don't touch the internal part carelessly, or you may get an electrical shock and it can be lethal for you.

  Please be careful.

- If the vacuum tube 3-500Z gets a strong physical shock, tube glass, internal electrodes and pins may be damaged.

  In case of transporting over a long distance, please pull off the tubes from the device and pack them separately with a care to be free from a strong shock.

[2] FEATURES

1. HL-2K is an HF all band linear amplifier with maximum input of 2.4KW designed with state of the art and our especial RF technology.
   Uses two vacuum tubes, EIMAC 3-500Z glass triode, which is reputable for a good sound and most durability in grounded-grid circuit.

2. With a large power supply using a quality transformer and high voltage full bridge rectifier circuit, this model is stable even under the key-down, continuous operation for a long time.

3. HL-2K covers 1.8 - 28MHz ham bands including new WARC bands.
   It is possible to be on air on 10MHz and 18/24.5MHz bands as well.

4. Two large meters have been set on the front panel.
   Plate current(IP) can be monitored all the time by Plate Current Meter, and plate voltage(EP), control grid current(IG) and output power(PO) can be monitored by multi-function meter, so that each operating state can be checked easily.
   With a built-in precision power sensor at the RF power detection unit, an accurate output power measurement has been achieved.

5. Cooling fan off-delay circuit has been furnished to avoid shortening the life of vacuum tubes and to cool off the internal part caused by remaining heat of tubes.
   The fan continues to run for 150 seconds after power switch off.

6. Vernier mechanism is furnished not only at plate variable capacitor but also at load variable capacitor, which makes output tuning much smooth.

7. All chassis are ruggedly built to support a large power transformer and heavy components.

8. By our accumulated researches for cooling whole vacuum tubes, an highly effective forced-air cooling system is employed to cool from the pins to top of tube.
   It makes the amp reliable and durable even for a continuous long hours of operation.

9. To avoid a high voltage electric shock, double inter-locked switch system is furnished, which is shuts down the power supply primary automatically and shorts a high voltage circuitry at the same time, when the upper shield cover is taken off.
   And thus the counterplan for safety is fully considered.

[3] SPECIFICATIONS

Frequency band	: 1.8(1.9)/3.5(3.8)/7/10/14/18/ 21/24.5/28MHz all amateur band
Mode	: SSB, CW, (RTTY, SSTV)
Exciting power	: 60 - 120W
Final DC input power	: 2.4KW PEP
Output power	: 1.2KW max.(at SSB)
Plate voltage	: DC 3400V(at no RF excitation)
Plate current	: 800mA max.
Input/output impedance	: 50Ω(unbalanced)
Input/output connector	: M-R type(SO-239)
Vacuum tubes	: EIMAC 3-500Z x 2
Semiconductors	: Transistor x 1, Diode x 37, LED x 2
Class of operation	: Class AB2, Grounded grid(with input tuning circuit)
AC supply voltage	: AC 100/110/117/120/ 200/220/234/240V 50/60Hz 25/13A max.
Built-in meters	: Plate current meter : IP - 1A(full scale) Multi-function meter: IG - 500mA(") PO - 2KW(") EP - 5KV(")
Cooling method	: Forced-air cooling
Dimensions	: 405(W) x 200(H) x 390(D) mm
Weight	: 35 Kg(approx.)
Accessories	: 15A Fuse(spare) x 2, RCA pin plug x 2(Control/ALC), Jumper cable x 2(power source terminal)

[4] AC POWER SOURCE

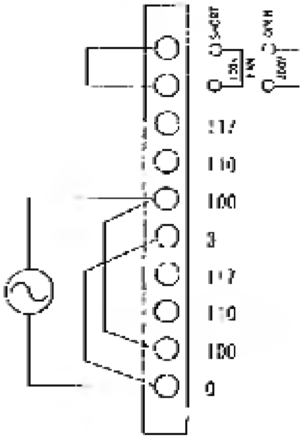
1. Terminal board is furnished at AC primary side of the power transformer to select the proper voltage taps.

   The taps have been set for 200V at the time of shipment.

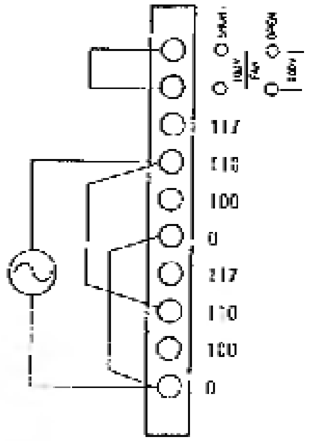
   For other AC voltage, please change the connection of harmonica terminal according to following illustrations.

2. AC pin/plug has not been supplied, please use the conventional AC pin/plug in your country.

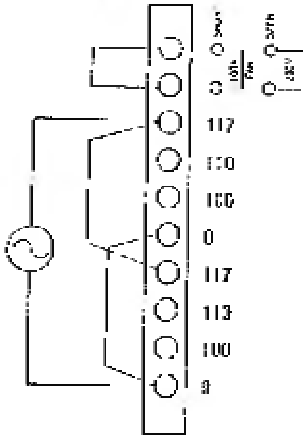
(A) 100V



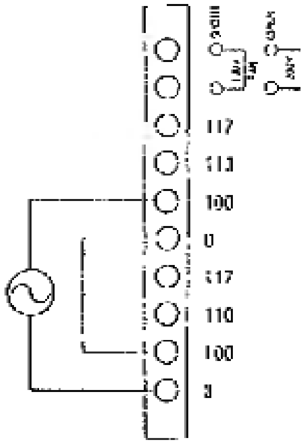
(B) 110V



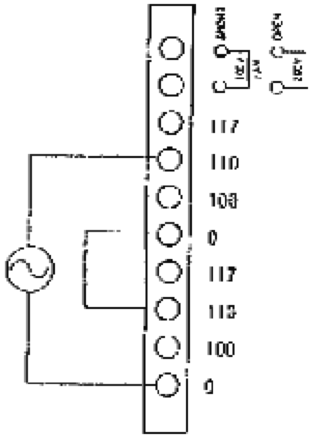
(C) 117/120V



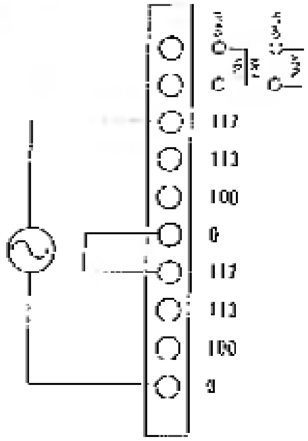
(D) 200V



(E) 220V



(F) 234/240V



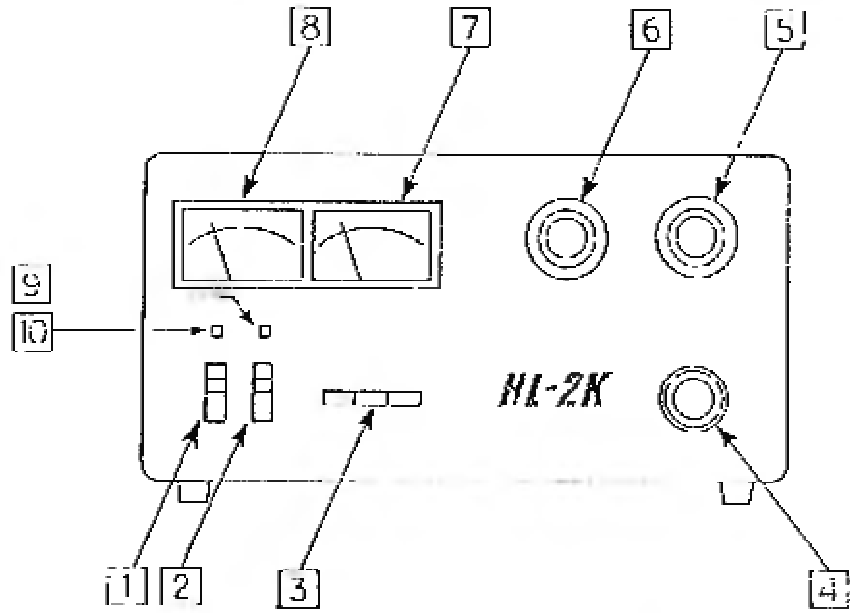
3. 15A fuses are always used even if the voltage changes. Please be sure to check the terminal connection if they are wired correctly.

   Caution

   When you change the voltage taps from 200V operation to 100V, don't forget to change the connection of OPEN/SHORT terminals for FAN at upper side of terminal board.
   Short(100V) at 100-120V, OPEN(200V) at 200-240V.
   In case of misconnection, internal damage to tubes will occur, caused by trouble or reduced revolutions of fan(insufficient cooling). Please be careful!

[5] EXPLANATIONS OF FEATURES

*Front panel



1.POWER OFF/ON : Power switch on/off.
At power switch off, the amp is made "THRU"
state. At power on, various voltages are applied
to internal part and [10] LED(red) lights.
Even if you turn off this switch at this state,
cooling fan keeps running for approx. 150 seconds
with a fan motor off-delay circuit.

2.STBY/OPER : Operation select switch.
At STBY position, the amp is made "THRU" state,
and output power of transceiver or transmitter
will bypass the internal part and reach antenna.
At OPER position, the amp can be on air.

3.METER : Multi-function meter [7] select switch.
Select IC/PO/EP indication.

4.BAND : Frequency band select switch.
Select operation band(same band as your transceiver or transmitter.)

5.LOAD : Knob for adjusting LOAD variable capacitor.
6:1 vernier mechanism is furnished.
By adjusting this knob, an effective RF power
is supplied to the load.

6.PLATE : Knob for adjusting PLATE variable capacitor.
6:1 vernier mechanism is also furnished for an
easy tuning.

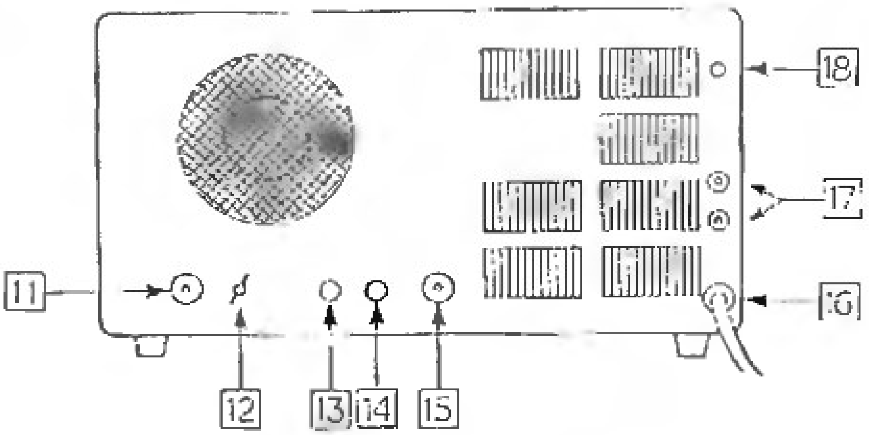
7.IG.PO.EP : Multi-function meter. By selecting $\boxed{3}$ METER switch, you can read IG(control grid current), PO(RF output power) and EP(Plate voltage) respectively.

8.IP : Plate current meter. Indicates plate current of the vacuum tubes. Full scale : 1A

9.ON AIR(LED) : On air pilot lamp. Indicates the amp is on air state.

10.POWER(LED) : Power pilot lamp. Indicates the power is on.

*Rear panel



11.RF OUT(ANT) : Output terminal of linear amp. Connects load(antenna or dummy load) here.

12.GND : Ground terminal.

13.ALC OUT : ALC voltage output terminal. With RCA pin/plug of accessory, connects cables to ALC input terminal of transceiver or transmitter.

14.REMOTE : Terminal for remote send/receive control operation. By connecting lead wires between control terminal of transceiver or transmitter and this terminal using RCA pin/plug of accessory, send-receive changeover can be made automatically. (For connection of the exciter side, please refer to its instruction manual.)

15.RF IN(TX) : Input terminal of linear amp. Connects cable from antenna terminal of transceiver or transmitter.

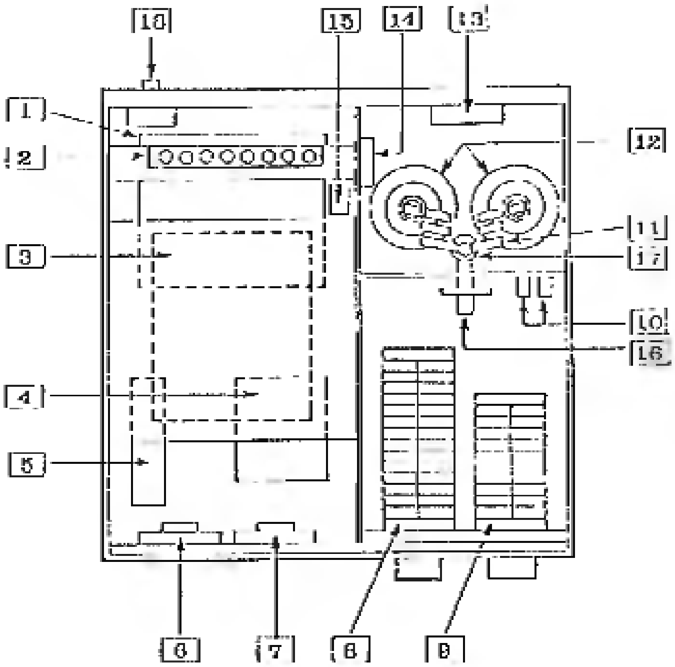
16.AC POWER : AC power cord.
AC pin/plug hasn't been supplied.
Please use suitable one at your location.

17.FUSE : 15A fuse holders.
When fuse blows, check the cause and treat,
then replace it.

18.ALC ADJ : Adjusting knob for $\boxed{13}$ ALC OUT(ALC output voltage).
Adjust this not to exceed proper exciting power
level from transceiver or transmitter to the amp.

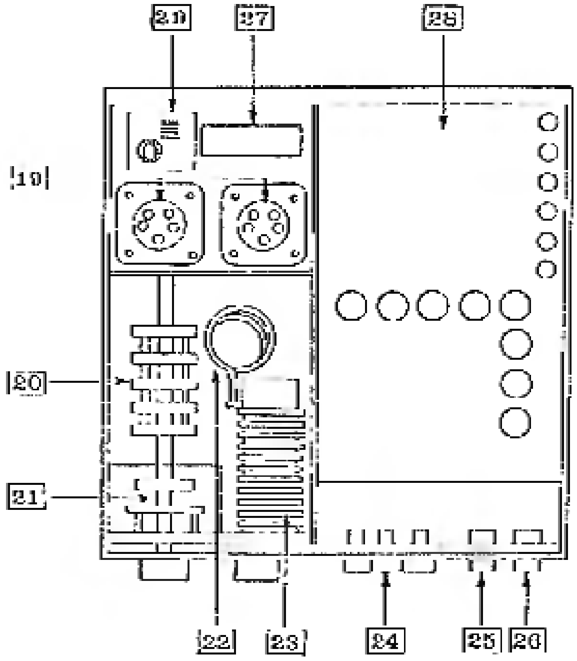
*INTERNAL VIEWS

°Upside of the chassis



1 HIGH VOLTAGE POWER TRANSFORMER
2 AC SOURCE TERMINAL BOARD
3 HIGH VOLTAGE RECTIFIER UNIT
4 LOW VOLTAGE POWER TRANSFORMER
5 CONTROL UNIT
6 PLATE CURRENT METER
7 MULTI-METER
8 TUNING VARIABLE CAPACITOR
9 LOADING VARIABLE CAPACITOR
10 ANTENNA RELAY
11 PARASITIC OSCILLATION SUPPRESSOR COIL
12 VACUUM TUBE 3-500Z x 2
13 COOLING BLOWER
14 INTERLOCK SWITCH(HIGH VOLTAGE SIDE)
15 INTERLOCK SWITCH(AC SOURCE SIDE)
16 COUPLING CAPACITOR
17 PLATE RF CHOKE COIL
18 ALC ADJUST KNOB

BOTTOM VIEW



19 SOCKET FOR VACUUM TUBE/AIRDUCT

20 BAND SELECT SWITCH

21 RF INPUT TUNING CIRCUIT BLOCK(SHIELD CASE)

22 TANK COIL(HIGH BAND)

23 TANK COIL(LOW BAND)

24 MULTI-FUNCTION METER SELECT SWITCH

25 STBY/OPER SELECT SWITCH

26 POWER ON/OFF SWITCH

27 FILAMENT CHOKE

28 POWER SUPPLY UNIT BOTTOM BOARD

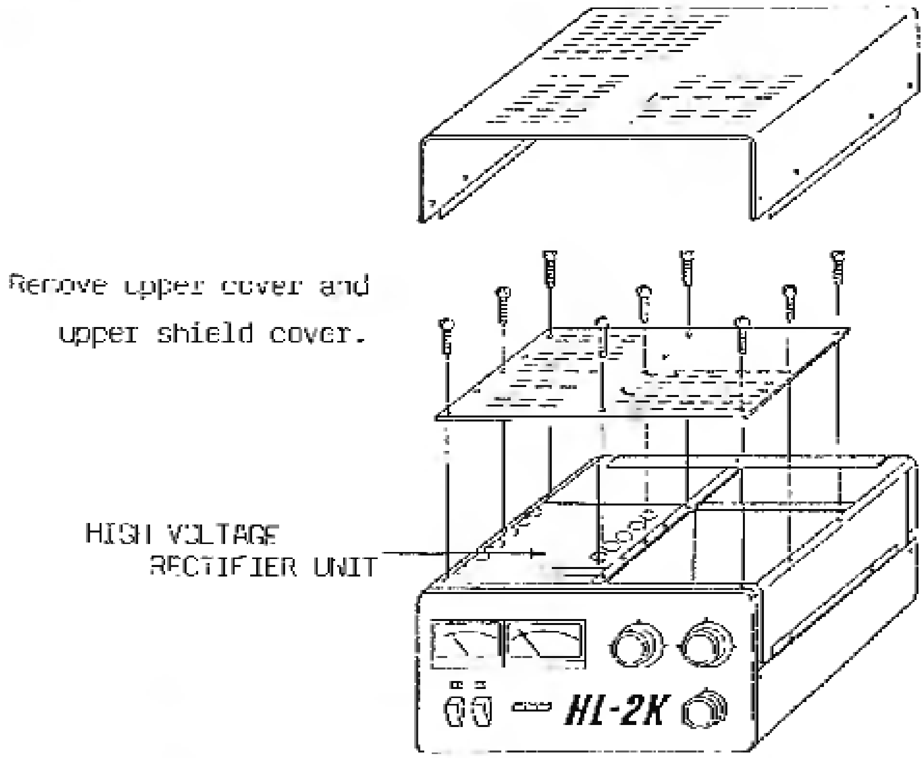
29 POWER DETECTOR UNIT

[7] HOW TO SET THE VACUUM TUBES

** To protect the vacuum tubes, 3-500Z x 2 have been packed separagely from the device at the time of shipment.

Please connect AC cord after vacuum tubes have been set certainly.

1. Unscrew the fixed screws and remove upper cover and upper shield cover.(Nuts on the upper shield panel are for high voltage inter-locked switch. Don't remove these nuts.)



2. Insert 3-500Z holding the glass envelope into the socket according to the pin lay-out certainly. At this time, don't insert 3-500Z by force. Also keep the plate cap and parasitic oscillation suppressor coil raised for an easy tube installation.

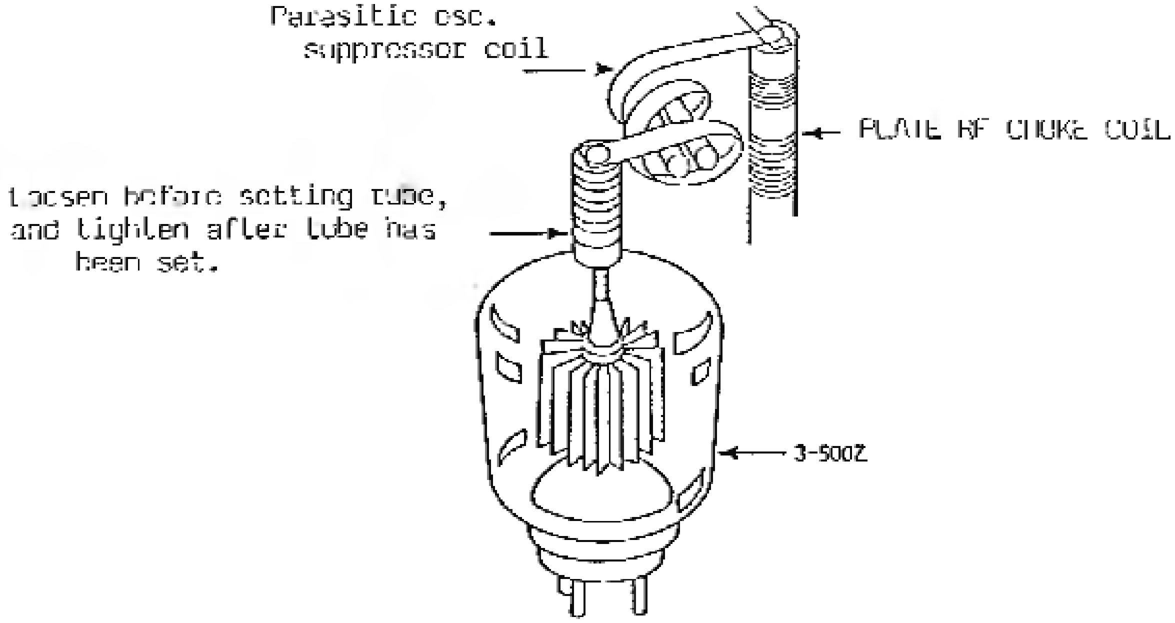
3. Loosen the screws at the side of plate cap, then, insert the plate cap into the matal protuberance of 3-500Z. then, tighten screws. (A short screw-driver may be helpful.)
If plate cap can not be inserted smoothly, you had better bend a parasitic osc. suppressor coil with a finger for smooth installation.

4. As the same way, set another 3-500Z.
It is easier to set the tubes one by one.

5. Be sure to check if parasitic osc. suppressor coil doesn't touch chassis, and if 3-500Zs don't get un-natural stress.
Then, set the upper shield cover and upper cover again.

The preparation is now finished.

** The upper shield cover must be always used, or the device can not be operated by inter-lock switch system.


Parasitic osc. suppressor coil
PLATE RF CHOKE COIL
Loosen before setting tube, and tighten after tube has been set.
3-500Z

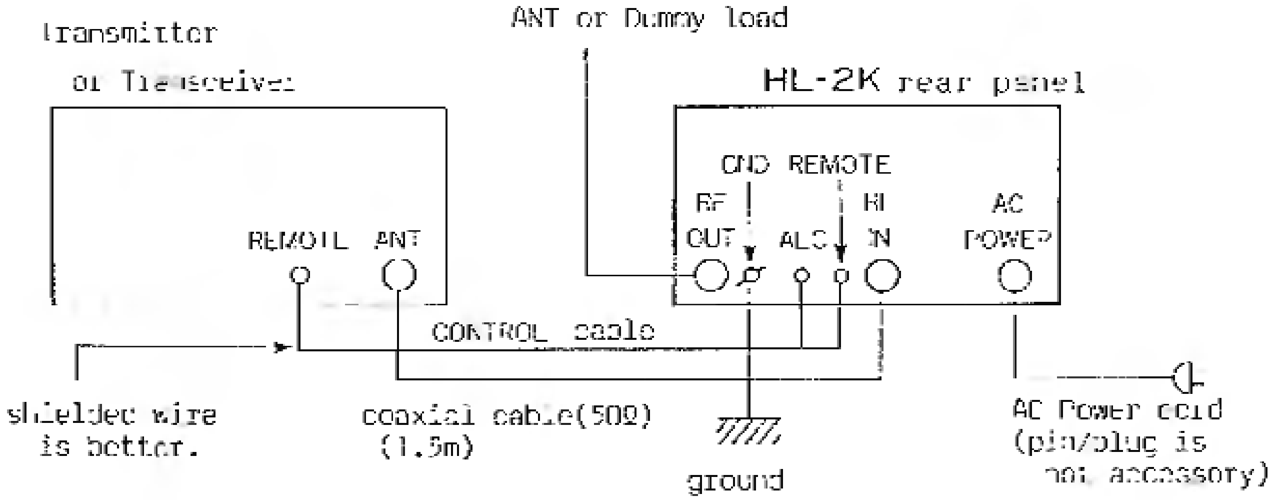
** CAUTION **

The pins of 3-500Z are weak mechanically.
Please handle 3-500Z carefully when you set or remove it by holding glass envelope.
Also please be careful of direction of socket pins and base (no ditches on the vacuum tubes).
All of unscrewed sixteen screws must be set firmly.

As the glass envelope of 3-500Z are made highly vacuumized, it is very dangerous if 3-500Z breaks and glass may scatter.
Please handle 3-500Z carefully not to break glass envelope.

[8] OPERATION

1. Connect jumper cables and power cord according to following figure.



** Connect cable from REMOTE terminal of HL-2K to the terminal of transceiver or transmitter which gets grounded at transmission.

** At a simple transmitting test without TX/RX remote control, it's no problem to connect REMOTE terminal of HL-2K to the ground momentary.

2. Set the band select switches of HL-2K and the transceiver or transmitter to the operation band.

3. Set the knobs of variable capacitors for Plate and Load to each corresponding position beforehand(at 50Ω load) according to the following chart. This chart is approximation as reference for starting.

FREQ(MHz)	1.8	3.5	3.8	7	10	14	18	21	24.5	28
PLATE	1.5	6.0	7.5	3.5	5.0	7.0	8.5	9.5	9.5	9.5
LOAD	1.5	5.0	5.0	2.5	3.0	5.5	6.5	7.0	7.5	8.0

4. Turn POWER switch on and check if fan motor is turning.
Then, turn STBY switch to OPER position.
As 3-500Z is a direct heating type vacuum tube, warm-up time for filament is very short(approx. 3 to 5 seconds), and the amp can be on air soon after power switch on.
Make your transceiver or transmitter is on air, ON AIR pilot lamp lights and idling plate current(IP) should run approx. 100mA.
Adjust carrier level of transmitter to get IP of approx. 500mA.

5. Turn Plate variable capacitor to make output power meter(PO) indication of increase and IP to dip.

6. Adjust Load variable capacitor to maximize the PO meter indication.

7. Now increase carrier output level of transceiver or transmitter to get IP of 800mA.
At this time, adjust each Load knob and Plate knob alternately to maximize the output power.
To achieve a clean output wave form, turn Load knob clockwise slightly to decrease PO(output power) by 5-10% from the maximum point, and set the Plate knob always to get IP(plate current) dipped.
During the above tuning, if proper tuning is not obtained, it may be dangerous due to excessive tube plate dissipation.
Please keep IP less than 400mA.
In case of changing frequency(including changing operation band), readjust from No.2 to 7 of this chapter.

** Try to finish this adjustment within a minute.
If it takes longer, please stop operation for a minute, and then start tuning again.

8. Operate HL-2K with ALC knob on rear panel adjusted to proper operating voltage according to the output power level of the exciter.
Set the ALC knob at the point where IG meter rarely deflects and power meter or IP indication is about to decrease slightly from the peak.
Be sure to check the output power is not exceeding 1KW(peak) after the adjustment.
To transmit a clear and not distorted signal wave,
It is recommended to apply ALC systme for sure.

[9] CAUTION

1.Impedance

When you operate the device, please always connect, as a load, a well-adjusted antenna or a dummy load of 50Ω.
In case that the antenna impedance is extremely off from 50Ω, please use the impedance matching circuit such as an antenna coupler etc.
If you transmit under no load or mis-matching condition, the expensive vacuum tubes may be deteriorated and output tuning circuit may get a damage.
You had better obtain VSWR of less than 2.0 or hopefully as low as 1.
Please be sure to check the withstanding power and insertion power of antenna, dummy load and antenna coupler etc, as the output power of this amp. is very high.

2.Place of Installation

Install the device horizontally(to protect the internal circuit of vacuum tube) at well-ventilated place where is not exposed to the direct rays of the sun.
Internal heat is discharged by the fan from rear panel.
Please keep the rear of device at least 15cm off from the wall, and not to cover air-holes of upper and bottom covers.

3.AC Power Source

The voltage taps have been set for AC200V at the time of shipment.
In case of differnt AC voltage, please change the connection of harmonics-terminal accordig to " [4] AC POWER SOURCE " on page 4.
If you run the device with AC100V, output pwoer might not achieve the rated level caused by the poor AC line regulation etc.
AC200V is recommended.

4.When you open the cover,

a)to check the internal part, as a high voltage is applied, please pull AC power plug off and check if high voltage has been discharged to prevent from getting an electric shock.
Be sure to check EP indication of 0(zero)V on multi-function meter.

b)don't touch or trim the semi-fixed variable resistor at power detector unit as it has already been factory adjusted.

5.Cooling Fan off-delay Circuit

To protect the vacuum tubes, coolong fan off-delay circuit has been furnished. Fan motor continues to turn for a certain time period (approx. 150 sec.) to cool the tubes after power switch turns off.
As this circuit furnished, don't pull off the power plug while the fan is turning, or fan stops and cooling may be insufficient, and it will cause the deterioration of an expensive vacuum tube.
Please be careful.

As the same way, please check if the capacities of indoor wiring and breaker.

6. Please clear dust in the internal part of the device once in a while, or cooling fan will not work effectively, and it may lead to the troubles of high voltage leak or spark.

7. Grounding

It is recommended to take a good grounding when the device is used. A good grounding may prevent TVI, BCI etc, and electric shock. Connect a wire for grounding as thick and short as possible.

8. For a continuous transmission such as SSTB/RTTY modes, please reduce the driving level making output approx. 500W or less.

[10] TROUBLESHOOTING

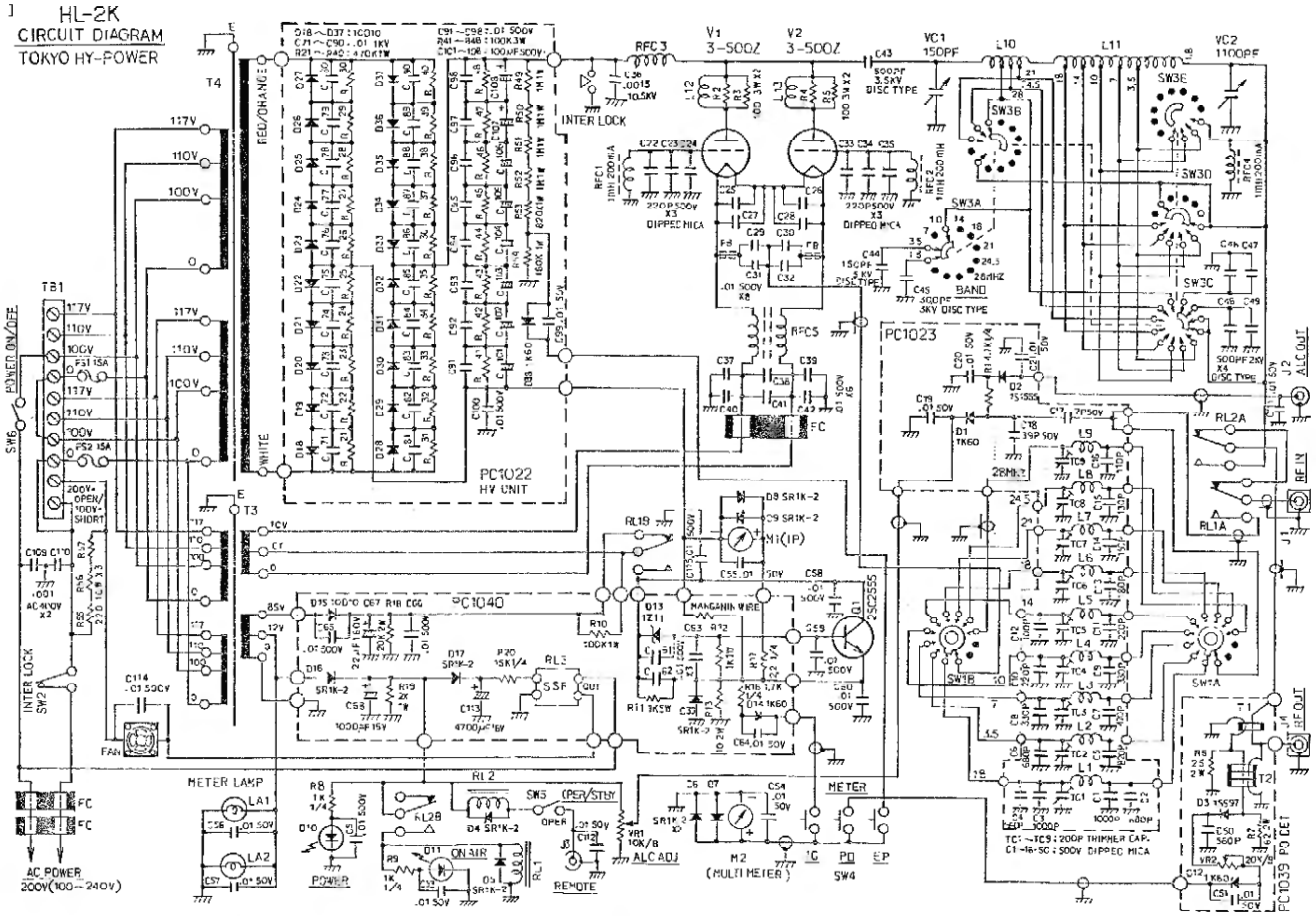
The following symptoms are minor troubles, which can be solved rather easily.

Please check each cause of trouble carefully.

Symptoms	Cause	Treatment
Can not turn on AC power.	1.AC fuse blown. 2.Upper shield panel has not closed completely (interlock switch is open state). 3.AC power cord isn't connected. 4.Mis-wiring of voltage taps at AC power terminal.	1.Replace fuse(15A). If fuse blows again, it should be a trouble. 2.Close upper shield panel completely. 3.Plug it firmly(surely). 4.Connect correctly according to instruction manual.
Fuse blown repeatedly.	1.Capacity of fuse is not proper. 2.Plate band or parasitic suppressor touchs other parts(chassis, tank coil for example). 3.Upper shield cover has not closed completely. (High voltage interlock is short-circuit state) 4.Mis-wiring of voltage taps at AC power terminal. 5.As tubes were not set, plate cap touched chassis, and high-voltage circuitry became short-circuit state.	1.Install correct fuse. (15A) 2.Keep space from other parts. 3.Close upper shield cover completely not to be short circuit high voltage interlock. 4.Connect correctly according to instruction manual. 5.Set the tubes correctly.
Fan doesn't turn round. (or turns round slowly.)	1.Mis-wiring of voltage taps at AC power terminal. 2.Some foreign substance are in the fan.	1.Connect correctly according to instruction manual. 2.Remove the substance.
EP(Plate voltage) is only a half compared with the normal level.	Mis-wiring of voltage taps at AC power terminal.	Connect correctly according to instruction manual.
IP(Plate current) at transmission is extremely low or zero.	1.Tubes are not set correctly. 2.Mis-wiring of voltage taps at AC power terminal.	1.Set the tubes into the sockets firmly. 2.Connect correctly according to instruction manual.

Symptoms	Cause	Treatment
	3.Deterioration of vacuum tubes. 4.It's not a transmitting state.	3.Replace tubes. 4.Be sure to check remote control cable.
PO(output power) is low or zero.	1.ALC adjusting knob has been turned fully clockwise. 2.Deterioration of the vacuum tubes. 3.Antenna terminal is open or short stage. 4.Mis-tuning. 5.Driving power from transceiver or transmitter is less than the rated level. 6.Connectors of coaxial cable between transceiver or transmitter and HL-2K are short or open. 7.Vacuum tubes haven't been set. 8.input and output connectors are connected on reverse side.	1.turn this knob counter-clockwise. 2.Replace the tubes. 3.Repair the open or short stage. 4.Tune correctly according to Instruction manual. 5.Adjust output level of transceiver or transmitter to reach HL-2K's rated level, so that enough RF output power can be achieved. 6.Replace coaxial cable or repair bad place. 7.Set the tubes correctly. 8.Set the connectors at the right position again.
"ON AIR" state cannot be made.	1.Cable for remote control is bad or not connected. 2.STBY/OPER select switch is not at OPER position.	1.Connect remote cable correctly. 2.Set this switch to OPER position.
Receiving signal cannot be received when STBY/OPER switch is at "OPER" position.	Short-circuit at remote cable.	Repair short-circuit.

HL-2K
CIRCUIT DIAGRAM
TOKYO HY-POWER

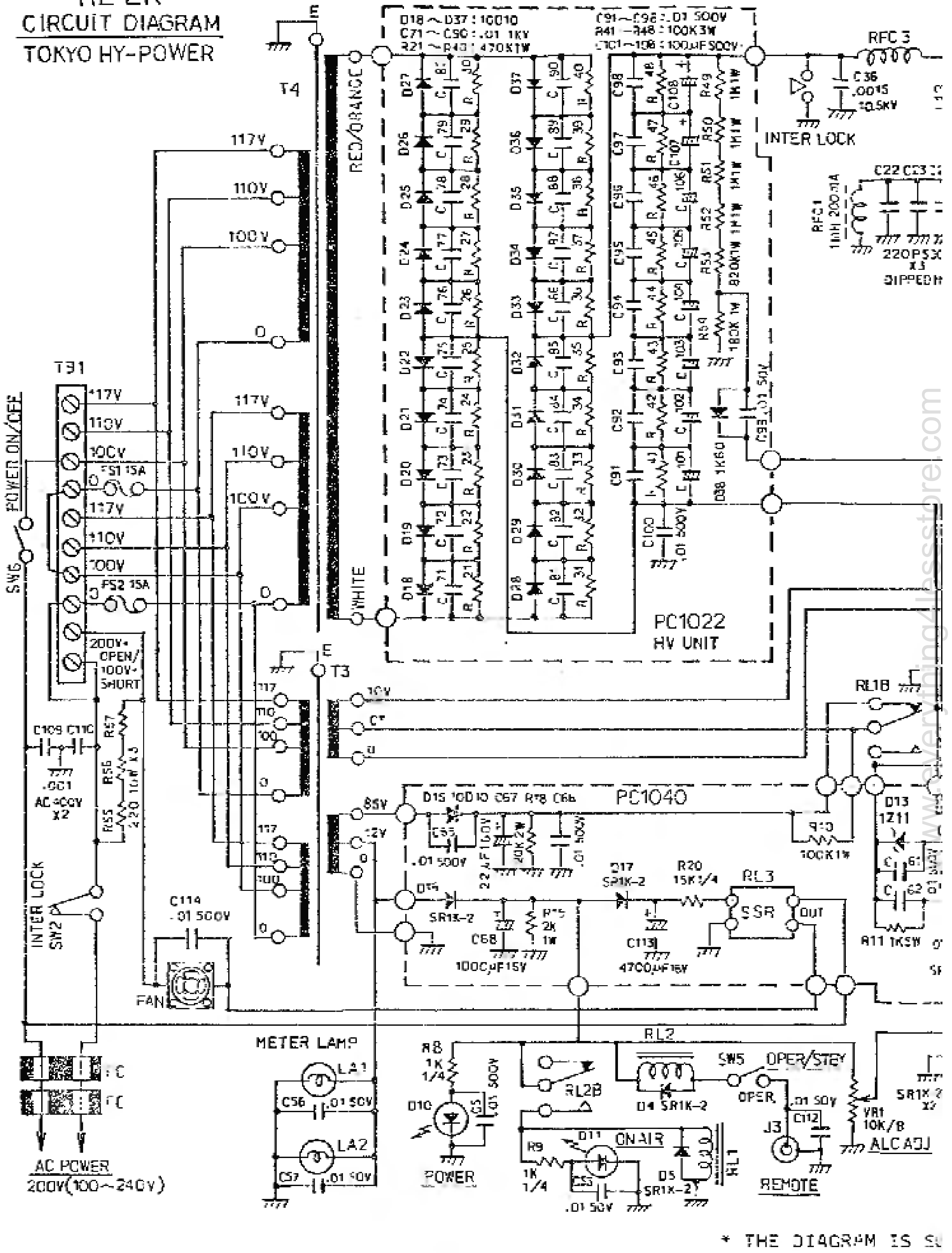


* THE DIAGRAM IS SUBJECT TO CHANGE WITHOUT NOTICE.

HL-2K

CIRCUIT DIAGRAM

TOKYO HY-POWER



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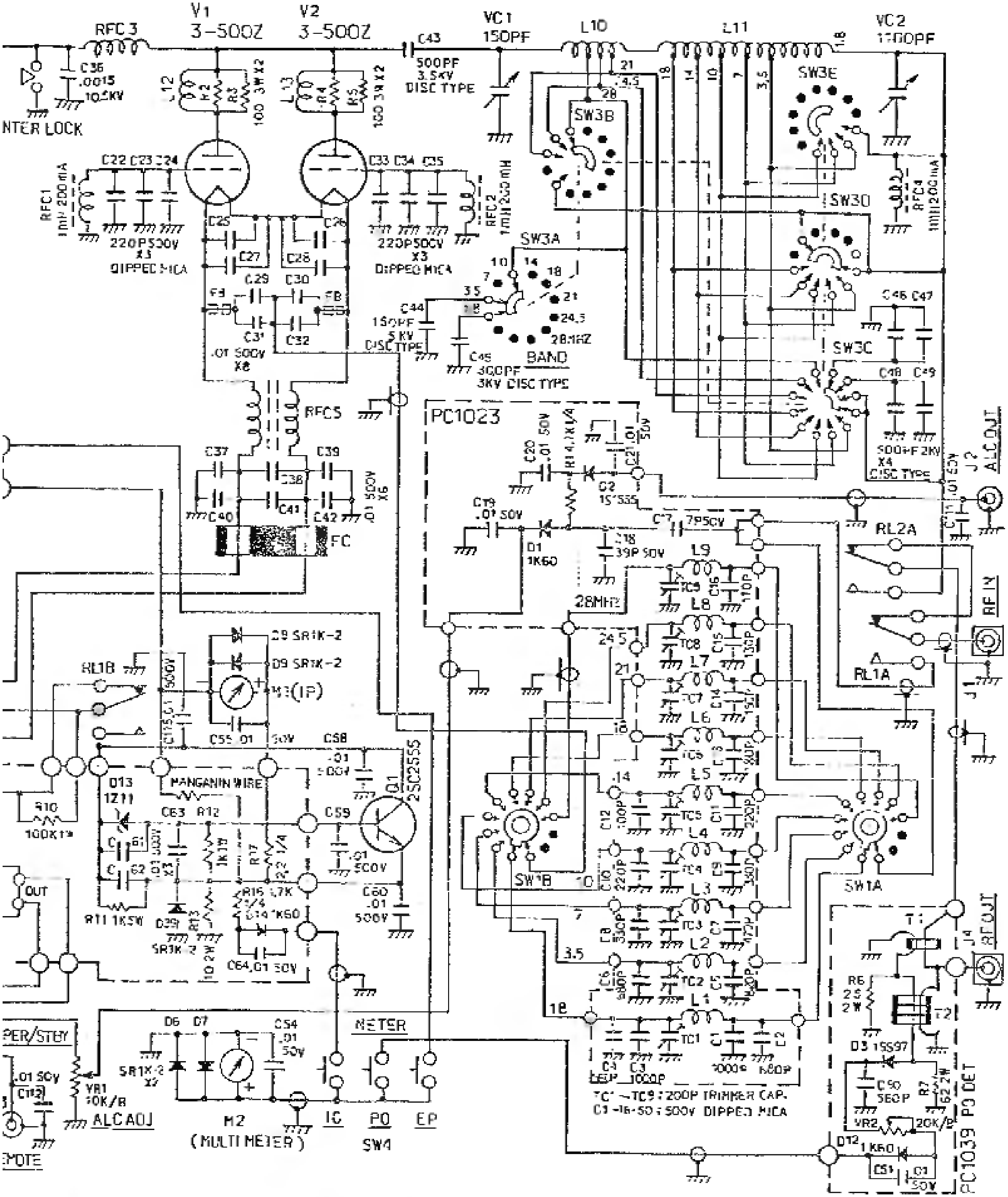

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